GPS Tutorial for Hikers

How to efficiently use your mobile as GPS navigator for hiking

By Marc TORBEY

Examples from the Android software OruxMaps V1.0





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Basics about GPS for hiking



Abbreviations used

- GE Google Earth (free software for computers)
- GPS Global Positioning System



- OM Orux Maps (GPS application for Android phones)
- POI Point Of Interest (on a map)
- WP Waypoint



GPS

Global Positioning System

- Several satellite around planet Earth, broadcast GPS "signals":
 - GPS devices receive satellite signals... no transmission
 - Weak signals from remote satellites, so...
 - perceptible Outdoors only!
 - 1st "GPS fix" requires user to be still (not moving)
- Origin of GPS systems
 - USA: NAVSTAR
 - Russia: GLONASS (since 2010)
 - UE: Galileo (available in 2020).
- Goals of GPS systems:
 - Basic goal: knowing your position on a map
 - Navigation: sea, land (car)
 - Orientation: hiking trips





GPS maps

Typically a digital map is either

- A **sophisticated software object** comprising a drawing of the landscape (with roads, public monuments, ...) + a database of POIs + some intelligent software capable of giving you directions to reach your destination POI.
 - Requires Internet connectivity, to access the latest maps and POIs.
 - Usually expensive

Example Google maps -



- Or a simple **picture**, showing the landscape and possibly the roads.
 - No navigation capabilities but...
 Ok for hiking!
 - Can be used off-line by software like OM
 - Usually available free of charge
 - Ex: Google Earth/ Hybrid —>



GPS objects - Waypoints

- A Waypoint is a point on the map, created in order to locate an important place on the map...
 - either by the "Create waypoint" function of the OM mobile (marks the user's current location)
 - Or by clicking a point on the "Map"
 - Or by some software
 - On Google Earth it is called a Placemark. (Add → Placemark)
 - On Nokia phones it is called a landmark
- Any WP can be used as target for orientation
 - A compass indicates the direction and the distance to it.
 <u>See page 26</u>.







GPS objects - Routes

A

- A **Route** is an ordered set of waypoints, used to guide you throughout your hike.
- It is created from waypoints ...
 - on the mobile, with software like OM
 - Or on the laptop using some software





GPS objects - Tracks

- A **Track** is a path walked by a hiker and recorded on his GPS device.
 - Used after your hike, to locate where you've walked and get statistical data.
 - A track recorded by another hiker could be uploaded to your GPS device (e.g. smartphone) and used to walk along this track as shown on your mobile's map.





File types – Useful software programs

- File types:
 - Each GPS vendor has developed its own GPS software which uses proprietary file types to describe the GPS objects. Example :*.lmx, *.trk, *.loc, *.hwr, etc.
 - Garmin navigators use *.gdb (Garmin database, version 3)
 - Google Earth uses *.kml (keyhole markup language)
 - The .gpx type was created as an effort to have a common file type, normally understood by all GPS navigators and GPS software.
 - A gpx file may contain any combination of WPs, routes and tracks.
 - OruxMaps uses .gpx and .kml types
- Useful software programs to have:
 - **Google Earth** is great for planning hikes! It requires a fast Internet connection.
 - A software to translate between all the different file types:
 - "GPS Babel" is the freeware to use.
 - A software to view a track on a map and get statistical information about it:
 - "GPS Track Viewer" is a good freeware, or on line, for example at

http://gpstrackviewer.free.fr/

Navigation towards a target point

- A few basic definitions
 - The target, is the next waypoint you want to reach on your route
 - The heading, in degree (0° to 360°, 0° being the north, 90° the east), which is the angle between the geographic north and the current direction you are looking at (the orientation of your phone); (ex: +30°)
 - The bearing of the target, in degree, which is the angle between the geographic north and the targeted waypoint, at your current location; (ex +120°)
 - The direction of the target, in degree, which is the angle between your current heading and the bearing of the target, at your current location; (ex : $120^{\circ} - 30^{\circ} = +90^{\circ}$)

Direction = bearing - heading



Before the hike

1. Downloading a digital map

2. Preparing to follow a *route*

3. Preparing to follow a track







Downloading a map for off-line use

Before you go hike in some nice place... you need to have a digital map of that place, accessible off-line on your mobile.

- With OM, you can *Create* a map easily, for off-line use
 - Make sure you have Internet connection on your mobile
 - In the Maps menu, select *Switch map*, then select the *ONLINE* tab.
 - Select your preferred map type, among the dozens proposed:
 - Good worldwide map types are Google Hybrid and Microsoft Hybrid
 - Look for the best available map covering the area of the planned hike
 - Check the max zoom level you want to have.



In the Maps menu, select Map Creator



- Select the map area you want to download: click 2 opposite corners of a rectangle, then ok ☑
- Input a map name
- Select the zoom levels you want (usually min= 10, max = 16, 17 or 18)
 - Check the map size in Mb (max = 1024 Mb), decrease max zoom level if needed.
- Tick Don't stop downloading if there are missing tiles' then click Download

Planning a hike

Creating a Route or Importing an existing track

- When you want to go hiking, in a place which you do not know well, there are 2 ways to find your way:
 - Using a software like GE, create a *route* = a set of several successive waypoints you intend to walk by, presuming there is a way to walk from one WP to the next.



- 2. Or, it is possible to hike along a *track* recorded by someone else...
 - from Wikiloc website or any other similar site = a database of tracks, or
 - sent to you by another GPS user you know, or even
 - recorded by yourself during a previous hike

In both cases, in order to exchange files between your computer and your mobile, you could create <u>once and for all</u>, the following folder on your mobile: .../oruxmaps/file_exchange

Planning a route using GE (overview)



Planning a hike route using GE (1/2)

Creating & importing the waypoints to the mobile device

- Planning a hike route = creating N placemarks on GE
 - On your computer, using GE :
 - ① repeat N times: Create several Placemarks on planned hike : Right-click on each of these placemarks, then select Save place as Plxx.kml.
 - Close GE.
 - ②Then merge these N files: re-open GE, File→Open then select all N files together (shift click). They appear in the left pannel under *Temporary Places*. Right-click this folder name and ask to *Save Place As* kml. ☺
 - Connect laptop to mobile, (unlock mobile screen). Then using
 windows file manager: copy the unique kml file to the mobile, under
 .../oruxmaps/file_exchange
 - ④ Using OM, Import the waypoints : Open the Waypoints menu, and :
 - Select Manage
 - Click Options android button, and select Import Wpts.
 - Select the folder /oruxmaps/file_exchange
 - Double-click on the the kml filename to import the WPs inside

The procedure described in this slide can also be used to import WPs from GE into OM (without aiming at creating a route)

Planning a hike route using GE (2/2)

Creating a route file using OM

- ⑤ Using OM, Build the Route:
 - Open the Waypoints menu, and select Manage
 - Use the Search menu or the Filter Menu to select ☑ only the WP making up your Route
 - Change the order of the WP by moving WPs up and down (point on left side icon $\ensuremath{\mathfrak{P}}$)
- © When finished Save the route
 - Click the Export button
 then select "KML"

The Route can now be seen as file "Waypoints__yyyymmdd_hhmm.kml" in the oruxmaps/tracklogs folder of the mobile.

Such a route file can be loaded anytime later and used for waypoint navigation. See slide <u>Route navigation</u>

Importing an existing track (overview)



Importing an existing track

- How to proceed ٠
 - OGo to the Wikiloc webpage <u>http://www.wikiloc.com</u>
 - Search for some track you like to walk (you can preview it on GE) and
 - download it to your computer, as a *.gpx file
 - ①bis Or save a .gpx track file received by email
 - Connect your Mobile to your computer and, using windows file manager, copy the *.gpx track to it, for example under .../oruxmaps/tracklogs
 - ③ On OM, check the presence of the imported file
 - Either by using the Route menu:
 - A • Or by using a mobile file manager
- \rightarrow Load file

- Other websites:
 - www.gpsies.com
 - www.mapmytracks.com

It's hiking day!



Starting the hike

At the starting point of the hike:

- 1. Switch on GPS reception on the Android phone
- 2. Launch OM and set GPS tracking On (also available in tracks menu).
- 3. Load the Offline map covering your hiking area
 - In the Maps menu, select Switch map, then the OFFLINE tab
 - Optionally, load the WPs on the map (Select all WPs, then 'eye')
- 4. Load (or create) the Route you intend to follow (see next slides)
 - to record your track, press "Start recording" in Tracks Menu
- Or Load the Track you intend to follow (see next slides)
- 5. Optionally, (for more safety), mark on the map the starting place by creating a new waypoint.
 - If you know the exact altitude of this starting point, you could calibrate your altimeter, (Options → Tweaks → Calibrate barometer)

Start walking and follow your GPS indications



Route navigation (Called in OM "Waypoint Navigation")

1) From a previously created route KML file,

a) Click button 'Routes' then \rightarrow 'Load File'

b) Double-click the desired file name "Waypoints__yyyymmdd_hhmm.kml"

c) Then in pop-up window called "Navigation options" select 'Wpt. Nav.'

2) Or from a set of Wpts in OM: see slide <u>Creating & following a route in OM (from existing WPs)</u>

3) Or from nothing : route created directly on map. See slide 25.

The **Wpt. Alarm** plays an alert message when you approach each WP



Options during waypoint navigation



Creating & following a route in OM (from existing WPs)

You have in your database plenty of WPs. You can select a few of them to make a Route, and start immediately following it

1. List all your WPs: Button 'Wpts. \rightarrow manage'



2. Browse the entire list, or use Search function, and tick the checkbox \square to the left of the WPs you wish to include in your Route.

3. Once you have selected all WPs, use WP 'Filter' option with option **'Selected Items**' **I**. By clicking on the 'ok', in the listing should appear only the desired WPs. (Or Filter by some other Wpts characteristics).

4. Reorder the Wpts as desired: hold the icon of the far left of each WP (drag and drop the Wpt up/down) <a>1.

5. Upload the route to the map viewer: press the second button from the left of the button bar (Routes).

Creating a route in OM (1/2) (without anything, directly on the map)

You don't have a prepared Route or Track, nor even WPs. You can still plan a route, directly on your OM\s map viewer.

To Create the route manually:



- 1. From the map viewer, Select button 'Tracks' \rightarrow Create'. This opens a box at the bottom of the screen, used to add Route points by hand (and simultaneously create a WP if the checkbox 'Create Waypoint' is active).
- 2. To do this move the map with your finger, place the *cursor* (\oplus) where you want to put the Wpt. and press the \oplus button. To erase the last WP created, use the '-' button. To complete the route, press the button 'OK' ☑; and to exit and cancel the route, select the \otimes button.
- 3. Now you have the Track file created and stored in the database. Then remove it from the screen (from the map viewer, button 'Tracks \rightarrow Remove')

Loading & following a route in OM (2/2) (from a hand-created route)

You have created in your database a route manually (prev. slide). You intend now to follow it.

- From the map viewer, select 'Tracks' or 'Routes'→ Manage. Some routes are listed.
- Click on the filename of the route you want to follow (Called "yyyy-mm-dd hh:mm") and select from contextual menu "Load as a Route"
- 3. Chose '*Wpt. Nav.*' from pop-up window.

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(Orux maps	👁 📕	1
Tracks		
2013-06-2	28 14:28	N 1989 (S
Durctil		Hiking 122 km
2012	T lit - un outlos	1,44 Km
2013	Calt properties	Hilcing
Durati	Delete from database	6.29 km
2013		
2013-0	Statistics	Hiking
Durati		6.12 km
2013	Load the Track	
2013-0		Hiking
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2013		
2013-0	Export as	Hiking
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2013-0	Sound by small or	Hiking
Durati	Sena by email as	0 km
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2013		
2013-0		Hiking
Durati	00 10 50	<u>9.72</u> 26



Heading = Bearing

Heading straight towards the target WP

If you rotate the mobile until the 2 arrows coincide \rightarrow you're headed straight towards the target!

Heading = Bearing (ex 310°)



Following a recorded track

Load the track path on the map viewer of OM:

- Select the Route menu: $\Lambda \rightarrow$ Load file
- In the /file_exchange folder, double-click the gpx filename (e.g. Chabrouh-Hrajel.gpx).
- In the Navigation options pop-up window , select Follow, click OK
- Select a map covering the area, and start walking along the drawn path.





Finishing the hike

At the finishing point of the hike

- In OM:
 - Stop the navigation (in Maps menu, "Stop Follow" or "Stop Wpt. Nav.")
 - If track recording was on, Stop it by pressing "Stop recording" in Tracks Menu
 - Set GPS tracking Off



- On Android notification screen,
 - Switch off GPS reception



After the hike

- 1. Get some instant statistics
- 2. Visualize *in 3D* on your computer the path you have walked!
 - Make sure you have ticked these 2 options in the OM settings for *Tracks/Routes*: Auto KML creation and Auto GPX creation
- 3. Share your track on wikiloc !

Instant statistics on OM

- At the end of the hike (and during the hike), you can get some statistics directly on your mobile:
- In OM, in *Tracks* menu, Select "Statistics"
 - You get a lot of interesting statistical data about your hike.
 - See example here

- Click on "See Graphics" button to see the profile of your hike
 - Tick Altitude and /distance

Orw maps	🌞 👛	
Statistics		
2013-07-19 09:20	16.38 km (07:04)	
Start time	Finish time	
07/19/2013 09:21	07/19/2013 16:25	
Average speed	Max. Speed	
2.31 km/h	9.5 km/h	
Avg. Speed Mov.	Moving time	
3.73 km/h	04:23	
Elevation gain	Elevation loss	
613 m	-612 m	
Maximum altitude	Minimum altitude	
22 57 m	1747 m	
Ascent time	Descent time	
03:22	03:06	
Ascent speed	Descent speed	
181.29 m/h	-197.26 m/h	
	Sections	
Altitude Heart Beats	Sections Speed Slope	
Interval, for speed and slope, in: m	100	

/time 🥥

/distance

See Graphics

Path visualization in 3D (overview)



Path visualization in 3D

At the end of the hike, the trackfile is saved on the mobile as gpx and kml files (in *oruxmaps/tracklogs* folder)

- ① Connect the mobile to your computer and, using the file manager
- ② Copy the .kml (and .gpx if needed) to your laptop.
 - Optionally: you can view the .gpx track profile + statistics using some GPX viewing software or website: Using an Internet browser: Go to gpstrackviewer.free.fr website, upload *.gpx track file to view the track in 2D. Optionally you can click the button "obtain a URL" and send the link to your friends in your report.
- ③ View the track in 3D using Google Earth:
 - Launch GE, select File→ Open and open the .kml file. Right-click anywhere on the path (between 2 track-points) and select "Show Elevation profile".
- Optionally report your hike to your friend by email: attach the *.kml track file
 - report the main statistical data: track length, time, total ascent, max elevation...

Sharing your track on Wikiloc



Posting your track on Wikiloc

- You have to create a Wikiloc account, once and for all, to be able to post (upload) tracks.
 - Go to <u>www.wikiloc.com</u> website and select Sign up.
- Posting your track
 - Preparation on your computer
 - Your recorded trackfile in gpx format
 - Some interesting waypoints added during the hike, also in gpx format (use GPS Babel if needed)
 - A maximum of 6 photos taken along the way (reduce their size first)
 - A short text description and counsels (driving directions, shuttle, views...)
 - Using your Internet browser:
 - Go to <u>www.wikiloc.com</u>, Sign in to your account,
 - Ask to upload a new track
 - upload the *.gpx track file and optionally the waypoint files
 - Paste your description text, Upload the photos (it is possible to add a legend to each photo).

The End



